Guardrail Requirements

- **WARRANTED**
  - Only if it Reduces the Severity of PotentialCrashes

- **LOCATION**
  - Get Between the Vehicle and the Hazard
  - Engage the Vehicle

- **PERFORMANCE**
  - Dissipate Some Energy by Moving Posts in Soil
  - Develop and Hold Tension
  - Crashworthy Terminal
Barrier Location in Relation to Edge of Pavement
(Two-Way Roadways) Figure 38-6B

$\text{LR} = \text{Runout Length}$
$\text{L1} = \text{Length needed for approach end}$
$\text{L2} = \text{Length of Hazard}$
$\text{LB} = \text{Distance to Barrier}$

Edge of traveled way
FIXED OBJECT ON HORIZONTAL CURVE

Tangential runout path
400'

Hazard
CZ

EDGE OF PAVEMENT

GUARDRAIL
A word about the Clear Zone.
Barrier between vehicle and hazard?
Barrier between vehicle and hazard?
Engage the Vehicle

- Height
  - Rail Height
  - Slopes
  - Curbs
    - Not generally recommended
      - Except with Type 6 Terminals
Rail height at 27-1/2 inches.

Accepted under NCHRP 350. About 27.5” is Minimal Height.
Rail height at 31 inches (MGS).
Resurfacing can reduce rail height.
Guardrail on Slopes

Edge of traveled way

Actual path of bumper height

1V:20H shoulder slope

7" to 8"
Rail on 6:1 slope.
25%.
Engage the Vehicle

- But not with the posts.
Posts Must Deflect

- Rotation of posts in the soil absorbs energy.
  - Too much support and posts yield, bending rail over posts, and adding too much load to rail.
    - Bent posts become launching ramp.
    - Rail tears
  - Too little support and rail must absorb too much of the load.
Rail cannot stand bending around rigid posts. Bent posts become launching ramps.
Rail cannot stand bending around rigid posts. Bent posts become launching ramps.
Rail cannot stand bending around rigid posts.
Some post resistance is needed.
Need deflection space for posts and rail.
Need deflection space for posts and rail.
Develop and Hold Tension

- Adequate Strength
- Anchorage
- Deflection Space
- Posts Must Deflect
This installation will not develop tension.
Discontinuities create snag points.
Cosmetic connections will not develop tension.
Full soil support is needed at transitions to rigid structures.
Rail must be strong enough to carry tension.
Capillary moisture in lap joint promoted continuing corrosion.
Rail continuity and rigidity did not contain car.
Radius Guardrail

- There is no Crashworthy Radius Guardrail
- Weakened Post System Partially met Old Criteria, but Only for 27.5” Rail
- Make an Effort to Keep Vehicles from Going Over, Under, Through, or Behind
Weakened post radius partially met old NCHRP 350, but may be used only with 27.5” rail systems.
Extensive research still has not solved radius rail design problem.
Crashworthy Terminal
Car hit ET-2000 at 80 MPH
Car after hitting ET-2000 at 80 MPH
Breakaway cable terminal, without full 4 foot parabolic flare. (Old Type 1A terminal).
Car was steering back onto the road.
Car got under terminal end.

Stopped in less than 6’-3”.
Took out front and middle seat passengers.
Truck hung over slope on rail overnight.
These have been replaced.
These can also kill.
Correct hardware is not the complete answer.
Why can’t it ever be simple?
What is the purpose of this installation?
Current State record.
Guardrail Requirements

- Functional Guardrail can Involve:
  - Earthwork
  - Utilities
  - Right of Way
  - Driveway/Side Road Location
  - Drainage (Ditch Location)

- Consider Roadside Design Early On
Guardrail Requirements

- Check to see if the guardrail shields the hazard.
- Make sure approach slopes to guardrail are 10:1 or flatter.
- Top of rail is 28” to 32” for MGS.
- Desirable top of rail should be 27.5” to 30” for old system.
- Check Standards for posts in rock or paved shoulder.
Guardrail Requirements

- Check for 3’ deflection space behind A rail posts (2’ behind B).
- Make sure the terminal cables are installed and taut.
- Provide grading according to Standards at all terminals
- Keep other hazards out of guardrail approach and deflection zone
Guardrail Requirements

- Use the Correct Terminal for The Rail System you are Using
- Avoid Radius Rail if at all Possible
Guardrail Requirements

- If things won’t come together, and corrections would be beyond the scope of the job, involve your designer, and they can contact BDE/BLRS and/or BSE for help in making the best of the situation.

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